SMART QR CODE GENERATOR

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Abstract—**QR codes were developed in the 1990s as a way to provide more information than a standard bar-code QR code was invented by a Japanese engineer Masahiro Hara from automobile manufacturer Denso Wave in the year 1994 to track the movement of car parts. QR codes consist of black squares arranged in a grid (matrix) on a white background and are read by specialized software that is able to extract data from the patterns that are present in the matrix. These codes are capable of containing more information than traditional barcodes, and primarily handle four modes of data: alphanumeric, numeric, binary, and Kanji. QR code means Quick Response Code. Now a day it is used widely in many organizations. QR codes are frequently used to track information about products in a supply chain. QR Code has increased in popularity in the later 2010s with improvement in optical capabilities of mobile phones and their wide adoption. Nowadays, QR codes are being used for wide variety of applications like, make online payments, check hotel menu, share Wi-Fi password, obtain price and other details of products etc. QR Codes have become so popular that now every new smartphone comes within built QR code reader.**

Keywords—QR code, Quick Response Code, Storage Capacity, Online QR Code Generator.

I.   INTRODUCTION

A QR code is a type of matrix bar code or two-dimensional code that can store data information and designed to be read by smartphones. QR stands for "Quick Response" indicating that the code contents should be decoded very quickly at high speed. The code consists of black modules arranged in a square pattern on a white background. The information encoded may be text, a URL or other data. The QR code was designed to allow its contents to be decoded at high speed. The popularity of QR codes is growing rapidly all around the world. Nowadays, mobile phones with built-in camera are widely used to recognize the QR Codes. QR Codes are created by the Toyota subsidiary Denso Wave in 1994, and was initially used for tracking inventory in vehicle parts manufacturing. The idea behind the development of the QR code is the limitation of the barcode information capacity (can only hold 20 alphanumeric characters). While they are developed for tracking parts in vehicle manufacturing, QR codes now are used in many other fields, from commercial tracking to entertainment, in-store product labeling, and in those applications that are aimed at smartphone users. Users may open URL; receive text after scanning QR codes. By using QR code generating sites or apps, users can generate and print their own QR codes for others to scan and use. The QR code system consists of a QR code encoder and decoder. The encoder is responsible for encoding data and generation of the QR Code, while the decoder decodes the data from the QR code.
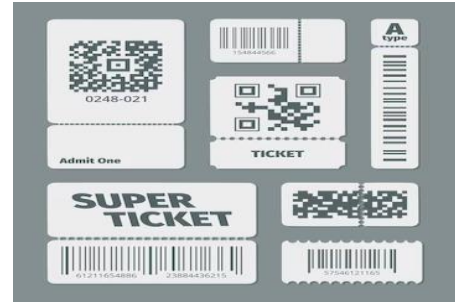

Figure 1.1: Different QR Code

The plain text, URL, or other data are given to the QR code encoder, and it generates the required QR code and when we want to access the data of the QR code, QR code is decoded via QR Code decoder (scanner) which retrieves the data of QR code.

Figure 1.2: Security Issue

The project mainly focused on the data capacity and the security feature, the commonly used QR codes have a drawback that they offer approximately 1GB of data capacity which is resolved in this project. Moreover, our project is also focused in providing better security experience by providing encrypted data feature.

Loads Of Data

Figure 1.3: Increased data capacity

VII.   LITERATURE REVIEW

Sr. no.	Publisher	Published Year	Technology Used	About
1.	Dae-Jea Cho and Mi-Young Bae Cho, Dae-Jea, and Mi-Young Bae. "A Study on Development of OTIP System using QR Code based on Smartphone." *International Journal of Multimedia and Ubiquitous Engineering* 9.10 (2014): 261-270.	2014	The user-friendly interface of the Smart QR Code generator must enable users to enter data and createQR codes. A front-end framework like React or Angular can be usedfor this.	A Study of Development of OTIP System using QR Code Based on Smartphones: "In this paper an automatic attendance check system based on smartphones utilizing the QR code for recognising the code using the built-in camera function of the smartphones."
2.	Iranna M. Shettar Shettar, I.M., 2016, April. Quick Response (QR) Codes in Libraries: Case study on the use of QR codes in the Central Library, NITK. In *Proc. TIFR-BOSLA National Conference on Future Librarianship* (pp. 129-134). Mumbai: Imperial Publications.	2016	The user-entered data must be safely saved in a database or file system. A database management system (DBMS) like MySQL or MongoDB can be used for this.	Quick Response (QR) Codes in Libraries: Case Study on the use of QR Codes in the Central Library: This paper explains the application of QR Codes in Library resource and service awareness activities. The present study focuses on a brief introduction to QR Codes along with how it works and their features.
3.	Md Rizal Md Hendry, Mohd Noah A. Rahman and Afzaal H.Seyal Hendry, M.R.M., Rahman, M.N.A. and Seyal, A.H., 2017, May. Smart attendance system applying QR code. In *12th International Conference on Latest Trends in Engineering and Technology May* (pp. 22-24).	2017	Based on the information given bythe user, the QR code generator must be able to produce QR codes. Usually, a programming language like Pythonor Java is used for this.	Smart Attendance System Applying QR Code: This paper focuses on developing an application by using a QR code. This system enables us to speed up the process of taking attendance and would save us valuable teaching time.

III. INFORMATION CAPACITY AND VERSIONS OF THE QR CODE

The symbol versions of the QR Code range from Version 1 to Version 40. Each version has a different module configuration or number of modules. (The module refers to the black and white dots that make up QR Code.) "Module configuration" refers to the number of modules contained in a symbol, commencing with Version 1 (21 × 21 modules) up to Version 40 (177 × 177 modules).

Figure 3.1: Compatibility of scanning

Each QR Code symbol version has the maximum data capacity, according to the amount of data, character type and error correction level. In other words, as the amount of data increases, more modules are required to comprise QR Code, resulting in larger QR Code symbols.

IV. QR CODE

QR Code has been approved as an AIM Standard, a JIS Standard and an ISO standard. In 2000 years, QR Code is being issued as National standard in China. The QR code provides 40 specifications and correct grade such as L, M, Q, H. A QR Code can hold a considerably greater volume of information: 7,089 characters for numeric only, 4,296 characters for alphanumeric data, 2,953 bytes of binary (8 bits) and 1,817 characters of Japanese Kanji/Kana symbols. QR Code also has error correction capability. Data can be restored even when substantial parts of the code are distorted or damaged. A. QR Code structure QR Code is comprised of black and white patterns on geometric plane surface in the two dimensions. It uses black pattern to stand for binary number 1, and white pattern to represent binary number 0. The QR code is capable of 360 degrees (Omni-directional). There are three finder patterns located at the corners.

QR Code contains information in both the vertical and horizontal directions, whereas a bar code contains data in one direction only. QR Code holds a considerably greater volume of information than a bar code.

B. Error correcting in QR Code.

QR Code has a function of an error correcting for miss reading that white is black. Error correcting is defined in 4 levels as below.

- level L: about 7% or less errors can be corrected.

- level M: about 15% or less errors can be corrected.
- level Q: about 25% or less errors can be corrected.
- level H: about 30% or less errors can be corrected.

C. Typical 2D Code

The comparison of the QR Code and some other kinds of 2D code.

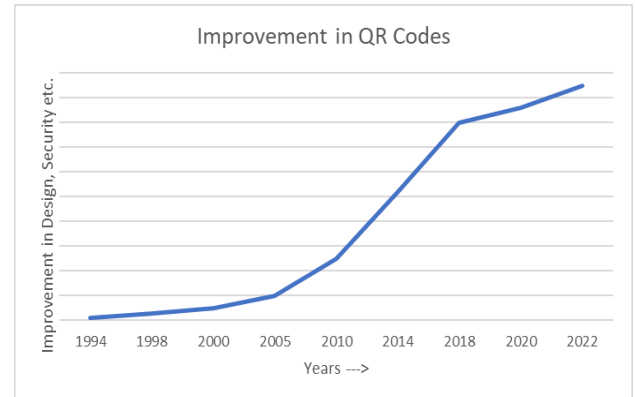Figure 4.1: Improvements in QR Codes

V. DRUPAL

Drupal is a free software package written in PHP language that allows anyone to easily publish, manage and organize a wide variety of content on a website. Drupal is part of a technology stack that contains a number of important pieces as Server, operating system, Database, Web server, and PHP Drupal's module system is based on the concept of "hooks". A hook is a PHP function that is named foo_bar(), where "foo" is the name of the module (whose filename is thus foo.module) and "bar" is the name of the hook. Each hook has a defined set of parameters and a specified result type. To extend Drupal, a module need simply implement a hook. When Drupal wishes to allow intervention from modules, it determines which modules implement a hook and calls that hook in all enabled modules that implement it.

VI. QR CODE ERROR CORRECTION

QR Code employs error correction to generate a series of error correction code words which are added to the data code word sequence which enable symbol to be read even if it is dirty or damaged. The QR code achieves powerful error-correction capability by using Reed-Solomon codes, a widely used mathematical error-correction method. Four levels of error correction are available, higher level has high capability of recovery. When selecting the level of error correction, environmental conditions as well as the desired size of the QR Code symbol need to be taken under consideration. For example, Level Q (25% error correction) or H (30%) may be required for factories or other applications where the QR Code is likely to become dirty or damaged. For clean environments and codes containing a large amount of data, Level L (7%) may be selected. In general, Level M (15%) is most frequently used.
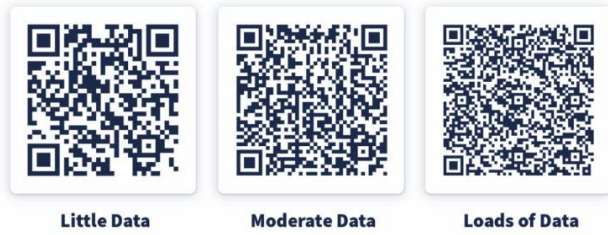
Figure 6.1: Data Capacity in QR Code

VII. STRUCTURE OF A QR CODE

Each QR Code symbol shall be built of square modules arranged in a regular square array and shall consist of function patterns and encoding region. And the whole symbol shall be surrounded on all four sides by a quiet zone border. Function patterns are the shapes that must be placed in specific areas of the QR code to ensure that QR code scanners can correctly identify and orient the code for decoding. There are 4 types of function patterns; they are finder pattern, separator, timing patterns, and alignment patterns. Encoding region contains data, which represents version information, format information, data and error correction code words.
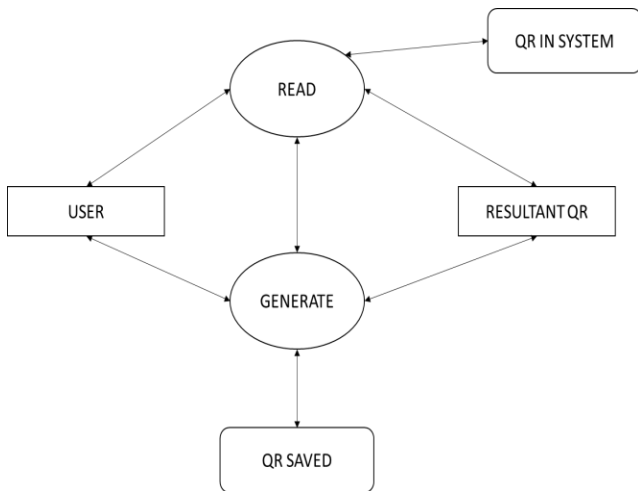

Figure 7.1: DFD Diagram

1. The User communicates with the system by entering data using the Scanner.
2. The QR Generator receives the data from the Scanner once it has read the QR code.
3. Based on the information obtained from the Scanner, the QR Generator creates a smart QR code.
4. The Storage contains the created QR code.

The database can also store the information about the QR code and how it is used for analysis and tracking in the future Finder Pattern: Finder patterns are the special position detection patterns located in three corners (upper left, upper right, and lower left) of each symbol. It consists of an outer dark square that is 7×7 modules, an inner light square that is 5×5 modules, and a solid dark square in the center that is 3×3 modules. The finder pattern is designed to be a pattern that is unlikely to appear within the other sections of the QR code so that QR code scanners can search for this ratio of light-to-dark modules to detect the finder patterns and correctly orient the QR code for decoding.
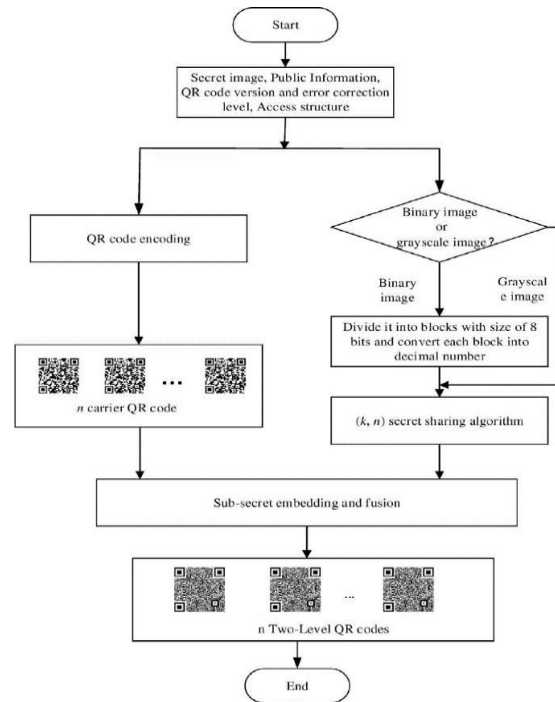

Figure 7.2: Block diagram of the proposed system

• Separators: Separators are the one-module wide areas of whitespace between each finder pattern and encoding region.
• Timing Patterns: There are 2 timing patterns, i.e. horizontal timing pattern and vertical timing pattern. They are consisting of alternating dark and light modules. The horizontal timing pattern is placed in the 6th row of the QR code between the separators. The vertical timing pattern is located in the 6th column of the QR code between the separators. These patterns are helpful in determining the symbol density, module coordinates and version information area.
• Alignment Patterns: An alignment pattern is constructed of 5×5 dark modules, 3×3 light modules and a single dark module in the center. QR codes that are version 2 and larger must have alignment patterns and the number of alignment patterns depends on the symbol version.
• Encoding Region: The encoding region contains format information, version information, data and error correction codes. For format information, the one-module array must be reserved near the top-left, top-right, and bottom-left finder pattern and version information, an area of a 6×3 block above the bottom-left finder pattern and a 3×6 block to the left of the top-right finder pattern is reserved.
• Quiet Zone: It is a 4-module wide area containing no data, and it is used to ensure that the surrounding text or markings should not misguide the QR code data.

VIII. METHODOLOGY

Algo for Frontend (React.js) – App.js:

```
});
  };

  return (
   <div>
     <label htmlFor="data">Enter data:</label>
     <input type="text" id="data" value={data}
onChange={(e) => setData(e.target.value)} />
     <button onClick={handleGenerateQR}>Generate QR
Code</button>
     <p>{message}</p>
   </div>
  );
}

export default App;
```

This pseudocode assumes you have set up a MySQL database, created a table called qr_codes, and have the necessary Node.js and React.js dependencies installed.

In the backend, the app.js file sets up an Express server and defines an API endpoint (/generate) to handle QR code generation and storage. Upon receiving a POST request with the data, it uses a QR code generation library to generate the QR code image and then saves it along with the data in the qr_codes table.

In the frontend, the App.js component renders an input field for entering the data, a button to trigger the QR code generation, and a message to display the result. When the button is clicked, a POST request is sent to the backend API (http://localhost:3000/generate) with the entered data. The response is handled, and an appropriate message is displayed.
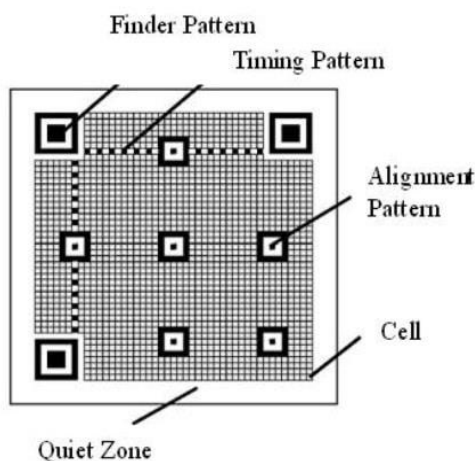

Fig 8.1 : QR Code Finding Pattern

Algo for Backend (React.js) – App.js:

```
// Import necessary packages
const express = require('express');
const bodyParser = require('body-parser');
const mysql = require('mysql');

// Create MySQL connection

const connection = mysql.createConnection({
 host: 'localhost',
 user: 'your_mysql_username',
 password: 'your_mysql_password',
 database: 'your_database_name',
});

// Create the Express application
const app = express();

// Use middleware to parse request bodies
app.use(bodyParser.urlencoded({ extended: true }));
app.use(bodyParser.json());

// API endpoint to generate and store QR code
app.post('/generate', (req, res) => {
 const data = req.body.data;

 // Generate QR code using a QR code generation library
 // qrCode variable represents the generated QR code image

 // Save the QR code in the database
 const query = 'INSERT INTO qr_codes (data,
qr_code_image) VALUES (?, ?)';
 const values = [data, qrCode];

 connection.query(query, values, (error, results) => {
  if (error) {
   console.error('Error saving QR code:', error);
   res.status(500).send('Error saving QR code');
  } else {
   res.status(200).send('QR code saved successfully');
  }
 });
});

// Start the server
app.listen(3000, () => {
 console.log('Server is running on port 3000');
});
```

VIII. BIBLIOMETRIC ANALYSIS

A quantitative strategy for examining the academic literature pertinent to a given study topic is bibliometric analysis. This project's bibliometric study entails a thorough search of academic databases for relevant papers, books, and other scholarly publications.
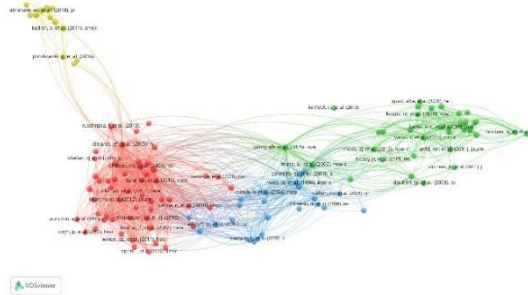

Figure 9.1: Bibliometric Analysis

IX. CONCLUSION

In conclusion, a Smart QR code generator has the potential to revolutionize the way data is accessed, making it much simpler and less time-consuming. Providing a platform to generate one's own personalized, secure, and affordable QR code which is a need of the hour as we are living in a fast-paced world where efficiency along with convenience is very important. The research shows that there is a strong need of this platform and there are various fields where the scope for this project implementation lies. Individuals, companies, or organizations looking for a novel way to communicate information, advertise their goods or services, or enhance their marketing tactics could be possible customers for the Smart QR code generator project. Retailers and e-commerce companies can create QR codes that link to their online storefronts, product pages, or promotional offers by using the Smart QR code generator. Additionally, they can run consumer loyalty programs or collect client feedback using QR codes. Event planners can use the Smart QR code generator to make codes that point to registration forms, speaker biographies, maps, or event schedules. The QR codes can also be used to host competitions or gather participant feedback. Educators can create QR codes that point to online learning resources, course materials, or assessment tools using the Smart QR code generator. Also, they can utilise the QR codes to develop interactive lessons or provide students feedback. Healthcare professionals can create QR codes that link to patient education materials, appointment calendars, or medical records using the Smart QR code generator. They can also utilize the QR codes to give people health advice or reminders. Contactless payment methods, event registration, ticketing, etc can also be done hassle-free with the use of Smart QR codes. Overall, a wide spectrum of potential customers can use the technology to disseminate information and improve their marketing plans. QR codes provide an easy and rapid way to obtain information and engage with digital content, and their use is expected to increase over the next several years.

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